INVERTER BUFFER STRUCTURE FOR A HYBRID VEHICLE

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims priority under 35 U.S.C. §119 of Japanese Patent Application No. 2004-305664, filed on October 20, 2004, the entire content of which is expressly incorporated by reference herein.

FIELD

The present invention relates to an inverter buffer structure used in a hybrid vehicle.

BACKGROUND

Conventionally, as described in Priuss New Car Manual, Part Number 7108100, pp.1-9, inverters for hybrid vehicles are disposed in the front engine compartment on the left side of the vehicle.

SUMMARY

The purpose of the present invention is to solve the aforementioned problem by providing an inverter buffer structure for a vehicle so that even when a head-on collision occurs, essentially no damage is caused to the inverter case and internal contents.

For one embodiment of the invention, an inverter buffer structure for a hybrid vehicle is disposed with an inverter in a front of an engine compartment of a vehicle and is provided with a buffer member between a front surface of the inverter and a radiator core support that constitutes a portion of the frame of the vehicle to reduce an incoming force to the vehicle in the event of a head-on collision.

Therefore, when the vehicle is in a head-on collision, since the buffer member is provided between the inverter and the radiator core support, even if the radiator core support gets deformed and bent toward the rear of the vehicle, it is prevented from directly impacting the front surface of the inverter. Thus, by buffering the impact applied to the front surface of the inverter by the radiator core support, damage to the inverter case and internal contents can be prevented.

For another embodiment, a hybrid vehicle is configured such that the engine is disposed on the right side of the vehicle and the inverter on the left side, but if the positional relationship of the engine and inverter were the opposite of this, needless to say, the inverter would be disposed on the right side of the vehicle.

BRIEF DESCRIPTION OF FIGURES

Figures 1a and 1b are respectively top and side views of a type diagram of one embodiment of an inverter buffer structure for a hybrid vehicle that pertains to the present invention.

Figure 2 is a type diagram showing the operating effects of the inverter buffer structure for a hybrid vehicle that pertains to the present invention.

Figure 3 is a plan view of a type diagram showing one embodiment of the buffer member for the inverter buffer structure for a hybrid vehicle that pertains to the present invention.

Figure 4 is a plan view of a type diagram showing another embodiment of the buffer member for the inverter buffer structure for a hybrid vehicle that pertains to the present invention.

Figure 5 is a plan view of a type diagram showing yet another embodiment of the buffer member for the inverter buffer structure for a hybrid vehicle that pertains to the present invention.

Figures 6a and 6b are respectively top and side views of a type diagram showing the vehicle fastening structure for the inverter of a hybrid vehicle.

EXPLANATION OF THE REFERENCE SYMBOLS

1. Inverter
2. Radiator core support
3. Buffer member
4. Bolt
5. Bolt
6. Bracket
7. Flat plate
8. Inverter tray
9. Bent plate
10. Clip
11. Transaxle

12. Inverter protecting bumper
13. Engine
14. Engine control unit
15. Resonator
16. Air intake duct
17. Air cleaner
51. Inverter
52. Engine
53. Transaxle
54. Radiator core support

DETAILED DESCRIPTION

Next, a detailed explanation of the most favorable configuration for the present invention is provided with reference to the Figures.

Figures 1a and 1b are respectively top and side views of a type diagram, according to one embodiment of an inverter buffer structure for a hybrid vehicle pertaining to the present invention. As shown in Figures 1a and 1b, this inverter buffer structure for a hybrid vehicle is disposed with an inverter 1 in a front engine compartment on the left side of the vehicle and is provided with buffer member 3 between the front surface of inverter 1 and radiator core support 2 that constitutes a portion of a frame of the vehicle to reduce the incoming force to the vehicle in the event of a head-on collision.

Therefore, as shown by the dashed-dotted lines in Figure 2, when the vehicle is in a head-on collision, buffer member 3 acts to prevent radiator core support 2 from directly impacting the front surface of inverter 1 when core support 2 gets deformed and bent toward the rear of the vehicle. Thus, buffer member 3 buffers the impact applied to the front surface of inverter 1 by radiator core support 2, and acts to prevent damage to the case and internal contents of inverter 1.

As shown in Figure 1a, buffer member 3 is supported by using bolts (not shown in the Figure) that fasten buffer member 3, in two places, to U-shaped bracket 6, which is securely fastened to inverter 1 itself by bolts 4 and 5 located on the sides of the vehicle. Therefore, compared to providing buffer member 3 on radiator core support 2, securely fastening buffer member 3 on the front surface of inverter 1 itself securely disposes buffer member 3 between radiator core support 2 and inverter 1 so that even if a head-on collision occurs and radiator

core support 2 gets bent toward the rear of the vehicle, radiator core support 2 is substantially absolutely prevented from directly impacting the front surface of inverter 1. Thus, by securely buffering the impact applied to the front surface of inverter 1 by radiator core support 2, damage to the case and internal contents of inverter 1 can be substantially absolutely prevented.

In addition, as shown in Figure 1b, a prescribed space *A* may be provided between buffer member 3 and inverter 1 in the front-to-rear direction of the vehicle. Therefore, compared to when a space is not provided between buffer member 3 and inverter 1, space *A* provides some leeway between when radiator core support 2 contacts buffer member 3 as core support 2 moves toward the rear of the vehicle during a head-on collision, as shown by the dashed-dotted lines in Figure 2, and when buffer member 3 gets pushed up against the front surface of inverter 1 and begins to get pressed and sandwiched between inverter 1 and radiator core support 2. This acts to further reduce the likelihood of damage to the case and internal contents of inverter 1.

Furthermore, as shown in Figure 1b, U-shaped bracket 6 is positioned so that it is higher than upper surface *B* of radiator core support 2. Therefore, as shown by the dashed-dotted lines in Figure 2, when a head-on collision occurs, contact between radiator core support 2 and U-shaped bracket 6 can be avoided so that the impact from the head-on collision is not passed directly to inverter 1 via bracket 6, and damage to the case and internal contents of inverter 1 can be prevented.

In addition, as shown in Figure 1b, a flat plate 7 that extends perpendicular with the front-to-rear direction of the vehicle is provided on the lower surface of buffer member 3 as a restraining means for restraining the lower surface of buffer member 3 in the front-to rear-position of the vehicle. A bent plate 9 that bends in either a zigzag or an "S" shape when viewed from the side of the vehicle is provided on a front end of an inverter tray 8, which supports the lower surface of inverter 1. A clip 10 is formed from flat plate 7 and bent plate 9 by fitting flat plate 7 into indented portion 9a of bent plate 9.

Therefore, although clip 10 restrains buffer member 3 with some degree of rigidity in the front-to-rear direction of the vehicle under ordinary driving conditions, it has less supporting rigidity than U-shaped bracket 6 in a head-on collision.

On the other hand, as shown in Figures 6a and 6b (respectively top and side views the vehicle) a configuration is generally employed in which the base of inverter 51 is fastened to a side member, not shown in Figures 6a and 6b, that extends in the front-to-rear direction of the body of the vehicle via a plate-shaped inverter tray, also not shown in Figures 6a and 6b. The engine 52 is shown in Figure 6a, and the transaxle 53 is shown in Figures 6a and 6b.

However, for this type of configuration, when the vehicle is in a head-on collision, radiator core support 54, which constitutes a portion of the frame of the vehicle, gets deformed and is bent toward the rear of the vehicle, as indicated the by dashed-dotted lines in Figures 6a and 6b. Therefore, radiator core support 54 impacts the front surface of inverter 51, causing a problem in that the case and internal contents of inverter 51 become damaged.

Therefore, as shown by the dashed-dotted lines in Figure 2, as radiator core support 2 moves toward the rear of the vehicle, clip 10 moves toward the rear of the vehicle by the same amount, and bent plate 9 and inverter tray 8 act to prevent the impact in the front-to-rear direction of the vehicle from passing directly to inverter 1 when a head-on collision occurs. In addition, when the vehicle is in a head-on collision, since buffer member 3 is securely disposed between radiator core support 2 and the front surface of inverter 1, the portion of radiator core support 2 that gets bent toward the rear of the vehicle is prevented from directly impacting the front surface of inverter 1. Thus, by buffering the impact applied to the front surface of inverter 1 by radiator core support 2, damage to the case and internal contents of inverter 1 can be substantially absolutely prevented.

Figures 3 through 5 are plan views of type diagrams of concrete embodiments of the aforementioned buffer member for the inverter buffer structure for a hybrid vehicle pertaining to the present invention. In Figure 3, the buffer member is a custom inverter protecting bumper 12. A transaxle 11 and an engine 13 are also shown in Figure 3. In Figure 4, the buffer member is engine controller unit 14. For example, ABS (Anti-lock Brake System) control unit, VDC (Vehicle Dynamic Control) control unit and 4WD (4 Wheel Drive) control unit may be substituted for the engine control unit. A transaxle 11 and an engine 13 are also shown in Figure 4. In Figure 5, the buffer member is resonator 15 (air intake part). Resonator 15 supplies fresh air to engine 13 via air intake duct 16 and air cleaner 17.

As explained above, although the effect of preventing damage to the case and internal contents of inverter 1 is achieved by any one of these embodiments, because an existing part is used as the buffer in the embodiments shown in Figures 4 and 5, a more advantageous

configuration can be achieved in terms of reducing the number of parts required and the weight of the vehicle, compared to when the custom inverter protecting bumper 12 shown in Figure 3 is provided.

The inverter buffer structure for a vehicle that pertains to the present invention provides more safety in the event that a head-on collision occurs and also improves the reliability of the vehicle.

CONCLUSION

Although specific embodiments have been illustrated and described herein, it will be appreciated by those of ordinary skill in the art that any arrangement, which is calculated to achieve the same purpose, may be substituted for the specific embodiment shown. For example, electric vehicle and fuel cell vehicle may be substituted for the hybrid vehicle. This application is intended to cover any adaptations or variations of the present invention. Therefore, it is manifestly intended that this invention be limited only by the claims and the equivalents thereof.